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A novel analytical model and energy analysis of thermal stresses in two-phase composites.

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Summary: This paper deals with analytical modelling of thermal stresses in a multi-particle-matrix system with isotropic spherical particles. These particles are periodically distributed in an isotropic infinite matrix. This model system which is characterized by microstructural parameters (particle volume fraction, particle radius) is applicable to two-phase composites of a precipitate-matrix type with isotropic phases. The thermal stresses originate during a cooling process due to a difference in thermal expansion coefficients. The analytical modelling which is based on fundamental equations of solid continuum mechanics represents a combination of different mathematical procedures applied to equilibrium and compatibility equations. This novel analytical model is compared with that which is based on mathematical procedures applied to the equilibrium equations only. The energy analysis of both analytical models which is applied to the SiC-Al_2O_3 composite is presented.

MSC:

74F05 Thermal effects in solid mechanics
74E30 Composite and mixture properties

Keywords:

thermal stress; two-phase composite; analytical modelling

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